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Our tracheostomy results in the intensive care unit, outcomes of 199 patients

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Abstract
Aim: The history of tracheostomy goes back to 3600 BC. Percutaneous dilatational tracheostomy was described in 1985 by Ciaglia. Percutaneous dilatational tracheostomy is quick, less traumatic, and has fewer complications. The aim of our study was to analyze the tracheostomy results of 199 patients in our Intensive Care Units.
Material and Methods: We included patients who underwent tracheostomy in our Intensive Care Units between January 2014 and December 2018 in Malatya Training and Research Hospital. A retrospective analysis was carried out for diagnosis, complications, surgical tracheostomy requirement reasons, demographics, comorbidity, ICU stay period, date of tracheostomy procedure, days to tracheostomy procedure from day of admission to ICU, days to tracheostomy procedure from initial tracheal intubation, days connected to mechanical ventilation, tracheostomy technique, urgent or elective, the final state of the patients were analyzed. Data were collected from the patients' records. The data of the study was evaluated through SPSS 'statistical package for social sciences' (spss17.0) 'program.
Results: The average age of discharged patients was 56.3 years and 74.4 for the dead patient group. There was a statistically significant increase between age and mortality, and between Apache II score and mortality ($p< 0.05$).
Discussion: According to our study results, percutaneous tracheostomy is a method with a low complication rate and easy applicability. No statistically significant results were found between the time from admission to the intensive care unit to the day of tracheostomy opening, the time to stay intubated, and mortality.

Keywords
Percutaneous, Tracheostomy, Intensive Care Units

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Introduction

Tracheostomy is a quite ancient surgical intervention, its history dates back to 3600 BC on Egyptian tablets. Chevalier Jackson described a surgical method for tracheostomy in 1932 [1)]. Ciaglia introduced the percutaneous dilatational tracheostomy (PCT) method developed over a guidewire in 1985 [2].

The tracheostomy procedure has some advantages, including enhancement of patient endurance, lessening the sedation requirement, protection of the larynx from irritation, improving nursing care, and reduction of dead space. Thanks to these benefits of the procedure, respiratory care and weaning from mechanical ventilatory support may be easier and more comfortable. The choice depends mainly upon the hazards and advantages of tracheostomy procedure versus prolonged intubation and the approval of the patient's relatives and clinical condition. There is no consensus on the accurate time for the tracheostomy procedure [3].

Thanks to the progress and developments in the treatment modalities for critically ill patients; prolonged mechanical ventilation and tracheostomy numbers have been increased [4]. The timing of the tracheostomy procedure remains unclear [5]. It can differ for each patient and according to the pathology [4]. Percutaneous tracheostomy is a fast, safe, simple procedure and has lower morbidity than surgical tracheostomy procedure [4,6,7].

The aim of our study was to analyze the tracheostomy results of 199 patients in our Intensive Care Units (ICU). We reported the diagnosis, complications, surgical tracheostomy requirement reasons, demographics, comorbidity, ICU stay period, the date of tracheostomy procedure, days to tracheostomy procedure from day of admission to ICU, days to tracheostomy procedure from initial tracheal intubation, the days connected to mechanical ventilation, tracheostomy technique, urgent or elective, the final state of the patient (died, discharged), which clinic the patient was admitted to ICU, APACHE II score.

Material and Methods

a. Study design

The study was created in the Intensive Care Unit of Malatya Training and Research Hospital. We started the study after the approval of the ethics committee of Malatya Clinical Research (ethical approval number: 2019/207). A retrospective analysis was carried out for 199 patients who experienced tracheostomy in our Intensive Care Unit between January 2014 and December 2018 in Malatya Training and Research Hospital. Data were obtained from the patients' records.

Data included diagnosis, complications, surgical tracheostomy requirement reasons, demographics, comorbidity, ICU stay period, the date of tracheostomy procedure, days to tracheostomy procedure from day of admission to ICU, days to tracheostomy procedure from initial tracheal intubation, days connected to mechanical ventilation, tracheostomy technique, urgent or elective, the final state of the patient (died, discharged), which clinic the patient was admitted to ICU, APACHE II score. One hundred ninety-nine patients who experienced tracheostomy procedures for prolonged intubation for mechanical ventilation were included in our study. The tracheostomy requirement was decided by the resident critical care doctor. Tracheostomy was performed after obtaining informed consent from the first-degree relatives of the patient. The majority of the procedures were carried out at the bedside by resident critical care doctor. The complicated ones (enlarged thyroid gland, coagulopathy, cervical mass etc.) were consulted to ear, nose, throat specialities. These difficult cases were performed by ear, nose and throat doctors in the operating room. The percutaneous tracheostomy technique was used in 184 patients and 15 patients experienced classical surgical procedures.

b. Technique

It was understood from the data that the Griggs technique was used for percutaneous tracheostomy. Percutaneous tracheostomy was performed as a bedside method in the ICU based on a standard protocol. The complicated ones (enlarged thyroid gland, coagulopathy, cervical mass) were consulted to ear, nose, throat specialities. These difficult cases were performed by ear, nose and throat doctors in the operating room and under the close control of an experienced critical care physician using the classic open surgical technique (ST).

Statistical Analyses

The data of the study were evaluated through the SPSS 'statistical package for social sciences' (spss17.0)'program. The average standard deviation value was calculated as a percentage.

Binary logistic regression analysis was used to determine risk factors as a probability by obtaining the effects of explanatory variables. Mortality and life status were defined as dependent variables. Age, gender, apache II score, duration of tracheal intubation from ICU admission to tracheostomy date, the tracheal intubation duration to tracheostomy were determined as independent factors. Since the variables were not suitable for normal distribution, the Mann-Whitney U test was used for non-parametric test statistics. In statistical comparisons, alpha error level was accepted as $p < 0.05$.

Results

A total of 199 patients underwent tracheostomy. The demographic data were demonstrated in Table 1. Pathologies for admission to the ICU includes ischaemic cerebrovascular disease, hemorrhage cerebrovascular disease, chronic obstructive pulmonary disease and pneumonia, congestive heart failure, hypertension, coronary artery disease, acute renal failure, multitrauma, amyotrophic lateral sclerosis, Guillain barre, cerebral palsy, gastric cancer, lung cancer, cerebral tumors, pulmonary thromboembolism, chronic renal failure, intracerebral aneurysm, Alzheimer. The most common diagnosis was chronic obstructive pulmonary disease in combination with pneumonia in 74 patients (37 %). The reasons for tracheostomy included prolonged intubation for mechanical ventilation in 153 patients (77 %), failure to separate from mechanical ventilation in 29 patients (14.5) and for maintaining easier secretion cleaning in 17 patients (8.5 %) (Table 2). Elective tracheostomy was performed in 182 patients and 17 patients underwent urgent tracheostomy procedure. The mean age was 73 years (range between 19-100 years); 107 patients were male (53.8 %) and 92 patients were women (46.2 %). The average duration of tracheal intubation from ICU admission to tracheostomy

was 23 days (range between 1-60 days). The average tracheal intubation duration to tracheostomy was 21 days (range between 1- 60 days). The mean length of stay in the ICU was 64 days (range between 11- 340 days); 184 patients (92.5 %) underwent PCT in ICU, 15 (7.5 %) patients experienced surgical tracheostomy in operating room. Patients required mechanical ventilation for an average of 62 days (range 10–330 days). The average APACHE II score was 23. Some patients were extubated and re-intubated before the tracheostomy during the ICU stay. The majority of patients, 136 (68.4 %), were transferred from the emergency department of our hospital to ICU. Internal medicine intensive care unit was following the emergency department with 23 patients (11.6%).

Table 1. Demographics

Demographics	n
Age	73 (19-100)
Gender	male 107 (53.8) /female 92(46.2)
Mean Stay On ICU	64 (11-340)
The Average Duration of Tracheal Intubation from ICU Admission	23 (1-60)
The Average Tracheal Intubation Duration to Tracheostomy	21 (1-60)
Total Time Mechanical Ventilation	62 (10-360)
Tracheostomy Method	Percutaneouseous 184 (92.5 %) surgery 15 (%7.5)
Tracheostomy Elective or Urgent	Urgent 17 Electively 182
Final State	179 exitus
	20 live
Apache	23 (10-45)

Table 2. Diagnosis, tracheostomy indications, complications and indications for surgical procedure

		n	%
Diagnosis	Ischemic Cerebrovascular Disease	49	24.5
	Hemorrhage Cerebrovascular Disease	7	3.5
	Chronic Obstructive Pulmonary Disease+Pneumonia	74	37
	Congestive Heart Failure Hypertension Coronary Artery Disease	47	24
	Acute Renal Failure	3	1.5
	Multiple Trauma	7	3.5
	Amyotrophic Lateral Sclerosis	2	1
	Gullian Barre	1	0.5
	Cerebral Palsy	1	0.5
	Gastric Cancer	1	0.5
	Lung Cancer	1	0.5
	Cerebral Tumors	1	0.5
	Pulmonary Thromboembolism	1	0.5
	Chronic Renal Failure	2	1
	Intracerebral Aneurysm	1	0.5
	Alzheimer	1	0.5
Tracheostomy Indications	Prolonged Intubation	153	77
	Failure to Separate from Mechanical Ventilation	29	14.5
	Inability to Clear Secretions	17	8.5
Complications	No Complications	193	97
	Decannulation Desaturation	1	0.5
	Subcutaneous Emphysema	1	0.5
	Bleeding	3	1.5
	Tracheoesophageal Fistula	1	0.5
Indications for Surgical Procedure	Cervical Mass	2	1
	Cervical Fixation	6	3
	Coagulopathy	2	1
	Short Cervical Structure	2	1
	Cervical Instability	2	1
	Tracheal Stenosis	1	0.5

Table 3. The relationship between Apache II score and mortality, duration of tracheal intubation from ICU admission to tracheostomy date and mortality, age and mortality, the tracheal intubation duration to tracheostomy and mortality

Paramaters	Final State	Mean±Std. Deviation	P
Age	Alive	56.3000±22.20266	0.000
	Exitus	74.4358±13.97992	
The Average Tracheal Intubation Duration to Tracheostomy	Alive	19.9000±12.30704	0.708
	Exitus	21.2291±10.17035	
Apache II Score	Alive	23.4000±9.78191	0.007
	Exitus	29.7970±6.88516	
The Average Duration of Tracheal İntubation From ICU Admission	Alive	21.7000±13.56117	0.584
	Exitus	22.9274±10.60741	

In total, perioperative complications were observed in 6 patients (3 %). Bleeding was observed in 3 patients, none of which was major and easily overcome. Tracheoesophageal fistula was developed in one patient, emphysema occured in one patient and decannulation in one patient. None of these patients died due to these complications. The complications are shown in Table 2.

In 15 patients, the otorhinolaryngologist performed a classical surgical tracheostomy in the operating. The indications for surgical procedure were cervical mass, cervical fixation, coagulopathy, short cervical structure, cervical instability, tracheal stenosis. One hundred seventy-nine patients (89.9 %) died during the ICU stay; 20 patients were transferred to the clinics related to their diagnosis. The relationship between age and mortality, Apache II score and mortality, duration of tracheal intubation from ICU admission to tracheostomy date and mortality, age and mortality, the tracheal intubation duration to tracheostomy and mortality were analyzed statistically (shown in Table 3). The average age was 56.3 years for discharged patients and 74.4 for dead patient group. There was a statistically significant increase between age and mortality, and between Apache II score and mortality. A one-year increase in age increases the risk of exitus by 1.07 times. The average Apache II score was 23.4 for discharged patients and 29.7 for the dead patient group. Similarly, one-unit increment in Apache II score increases the risk of exitus by 1.1 times ($p< 0.05$). There was no statistically significance between duration of tracheal intubation from ICU admission to tracheostomy date and mortality, gender and mortality, the tracheal intubation duration to tracheostomy and mortality ($p>0.05$).

Discussion

In this study, we analyzed 199 patients who underwent tracheostomy performed in our Intensive Care Unit. The

average tracheostomy opening day was 21 days, and the most common reasons for postponing tracheostomy were the refusal of patient relatives, the concurrent coagulation disorders. We analyzed the relationship between the tracheal intubation duration to tracheostomy and mortality. There was a slight increase between the tracheal intubation duration to tracheostomy and mortality rate, but we could not show this increase statistically (p>0.05).

Technological improvements, improved health circumstances, increased number of intensive care units have provided to follow up great numbers of critically ill cases and as a result, an inevitable increase in the number of tracheostomy attempts due to prolonged mechanical ventilation. PCT is a bedside procedure and does not require transportation of the patient to the operating room [8,9]. The time for tracheostomy for ventilated patients still remains unclear [10].

Early PCT maintains early separation from mechanical ventilation, lower pneumonia and lower mortality rates compared with late PCT [11,12]

Rumbak et al. attributed the high mortality rate of their patients to their high APACHE II scores of 27 and 26 for groups. Similarly, our mortality rate was high (89.9 %) [11]. We think that the mortality rate was high in our study due to comorbidities, high number of elderly patients, and long stay in ICU.

The relationship between age and mortality, Apache II score and mortality, duration of tracheal intubation from ICU admission to tracheostomy date and mortality, gender and mortality, tracheal intubation duration to tracheostomy and mortality were analyzed statistically in this study. The average age was 56.3 years for discharged patients and 74.4 for the dead patient group. There was a statistically significant increase between age and mortality, and between Apache II score and mortality. A one-year increase in age increases the risk of exitus by 1.07 times. The average Apache II score was 23.4 for discharged patients and 29.7 for the dead patient group. Similarly, one-unit increment in Apache II score increases the risk of exitus by 1.1 times (p< 0.05). There was no statistical significance between the duration of tracheal intubation from ICU admission to tracheostomy date and mortality, gender and mortality, tracheal intubation duration to tracheostomy and mortality (p>0.05). The average stay in the ICU was 64 days (range between 11- 340 days) in our study. Diaz- Reganon et al. reported that the mean stay in ICU was 21 days in their 800- patient study [7]. They did not report the diagnosis of their patient. We think that PCT is quick, less traumatic, has fewer complications according to the results of our study. Delaney et al. showed a lower incidence of bleeding and exitus ratio of PCT and better wound healing compared with surgical tracheostomy in their large series [13]. G. Diaz-Reganon et al. reported no exitus directly related to the tracheostomy in their study [7]. Fikkers et al. mentioned their major complication rate as 6 %, including bleeding, pneumothorax, and dilatation of a false tract [14]. Perioperative complications were observed in 6 patients (3 %) in our study group. Bleeding was observed in 3 patients and none of them were major and easily stopped. Two of these patients experienced surgical tracheostomy, the other haa a percutaneous tracheostomy. Tracheoesophageal fistula was developed in one patient, and this patient had experienced surgical tracheostomy. Emphysema occurred in one patient and decannulation in one patient. Emphysema and decannulation were developed in two patients that experienced percutaneous tracheostomy. None of these patients died due to these complications.

Bleeding was reported from 0 % to 20 % in the literature [15]. We observed bleeding complication in our three patients (1.5 %) parallel to the literature. We think that this ratio was low due to the number of experienced physicians ready for the tracheostomy procedure for each patient and our technique.

Minimal tissue disruption, tighty tamponade effects of tracheostomy tube, and adrenaline usage for local anaesthetic to the skin maintain minimal bleeding. Abnormal coagulation values especially affect the bleeding percentage [7,16]. Aberrant arterial anatomy was associated with fatal hemorrhage during the procedure [17,18]. Small incision maintains lower bacterial colonisation and stomal infection [7]. No stomal infection was found in our patients.

Limitations

Our study has some limitations. Since the number of tracheostomies opened with the surgical method was low, we could not compare with the PCT method. The accurate time for tracheostomy, complications, and other data should be analyzed in large series.

Conclusions

In this study, we observed that PCT can be performed by experienced anesthesiologists in patients hospitalized in the intensive care unit with a safe and low complication rate.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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